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ABSTRACT

Two projects conducted at the Center for Research on Learning and Teaching at the University of Michigan investigated factors involved in the adoption and dissemination of classroom innovations by college instructors. The first investigated the use of various instructional technologies among faculty members who received released time and financial support for the development and implementation of innovations in their courses and a random sample of faculty members who received no support. Results showed that the former group significantly increased their use of innovations whereas the latter showed no such increases. The second project focused on a random sample of faculty members and examined four factors used to predict the use of instructional innovations: (1) formal network--the extent to which respondents used various instructional support agencies, (2) informal network--the extent to which they relied on colleagues for information and support for teaching, (3) extrinsic reward--the extent to which respondents perceived teaching as a rewardable activity, and (4) intrinsic reward--the extent to which they found teaching and working with students personally satisfying. Support was found for formal network, extrinsic reward, and intrinsic reward as predictors, as well as a relationship between the use of instructional improvement agencies and the use of instructional innovations. (Author/RAO)

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Factors Involved in the Adoption and Dissemination of Instructional Innovations

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For the past several years I have been interested in studying the factors involved in the adoption and dissemination of classroom innovations by college instructors. In a 1978 study I evaluated a project supported by the Fund for Improvement of Post-secondary Education. This project, conducted at the Center for Research on Learning and Teaching at The University of Michigan, involved a small group of college faculty members in the re-examination of their teaching. The Faculty Fellows, as they were called, received released time and financial support for the development and implementation of instructional innovations in their courses. In addition, each fellow had access to technical assistance, equipment, training workshops, a series of seminars and personalized consultation with project staff.

The objectives of this project were to increase the use of various instructional technologies among participating faculty members, and in turn disseminate these innovations to others. A comparison of these faculty members with several other groups, including faculty members who applied for the program but were not accepted and a random sample of non-participating faculty members, showed that the faculty fellows significantly increased their use of innovations over a two year period. Another group, faculty members participating in a less intensive small grant program at the Center, also increased their use of innovations. Faculty groups not participating in CRLT programs showed no such increases.

Data collected from faculty fellow logs indicate that the fellows did interact with their colleagues concerning matters of instruction. However, results from follow-up questionnaires sent to contacted colleagues indicated that the primary functions of these contacts were to inform and influence the attitudes of the respondents. Few innovations were subsequently adopted as a result of these interactions.

The results of this study support the importance of instructional improvement agencies in the adoption of instructional innovations by these special groups of participating faculty. The interpersonal interaction of these faculty with their colleagues does not seem to be an effective means of subsequently disseminating these innovations.

Generalizability. But does this relationship hold for the general group of faculty? Cronbach (1975) expresses concern with the limited generalizability of controlled experiments. He contends that correlational studies are more environmentally valid.

A second study (Kozma, in press) focused on a random sample of 162 faculty members at The University of Michigan. Four factors were used to predict the use of the same set of instructional innovations examined earlier. These factors are: formal network (the extent to which respondents used various instructional support agencies), informal network (the extent to which they relied on colleagues as a source of information and support for teaching), extrinsic reward (the extent to which respondents perceived teaching as a rewardable activity) and intrinsic reward (the extent to which they found teaching and working with students personally satisfying). The correlations among these variables are presented in Table 1.

As can be seen each of the independent variables are significantly correlated with the number of innovations used. A multiple regression analysis was used to determine the relative predictive power of each of these variables. It was found that formal network, extrinsic reward and intrinsic reward, in that order, each contribute significant predictive power. The use of the informal network, however, added little predictive power once other variables were accounted for. The regression model is presented in Table 2.

These results correspond to those of the experimental study. A significant relationship exists between the use of instructional improvement agencies and the use of instructional innovations. Essentially no relationship exists between interaction with colleagues and the use of instructional innovations.

Causality

But, what is the causal relationship between the use of improvement agencies and the use of innovations? The answer to this question is not apparent from a correlational analysis such as multiple regression. The results of the experimental study would support the contention that the use of improvement agencies results in an increase in the use of innovations. But does this hold for the general group of faculty? Do most faculty members instead use improvement agencies because they need help with their innovations?

In the present study an attempt was made to specify the causal relationships among these variables by reanalyzing the data using path analysis. Path analysis is a correlational technique used to test a proposed causal model against observed data (Kerlinger & Pedhazur, 1973; Li, 1975).

Let us begin by examining causal Model A displayed in Figure 1. This proposed model depicts the causal relationships that would be predicted from the results of the experimental study. That is, the use of the formal network (2) results in the use of more innovation (1). In addition, the use of these innovations is a result of both extrinsic (3) and intrinsic (4) rewards. It can also be seen that these reward variables have an indirect effect as well, increasing the use of the formal network and in turn the use of innovations. Informal network was not included in this model because of its lack of power in the previous studies.

The path analysis proceeds by computing path coefficients for the proposed model. These indicate the strength of each causal relationship. Path coefficients are standarized partial correlation coefficients between two variables. Thus the

path coefficient between 1 and 2 (p_{12}) is the standardized correlation coefficient between these two variables holding 3 and 4 constant; the path coefficient between 4 and 2 (p_{24}) is the standardized correlation coefficient holding 3 constant, and so forth. The path coefficients in Figure 1 were computed in this manner.

The model is tested by the extent to which it can be used to reproduce the observed correlation matrix. This was done using a technique described by Kerlinger and Pedhazur (1973, pp 314-330) and is displayed in Table 3. The numbers in parentheses are the actual correlation coefficients. These pairings constitute an acceptable reconstruction of the correlation matrix and provide support for this causal model. Attempts to reconstruct an acceptable matrix after eliminating any of the causal connections in this model (say for example, the direct effect of 4 on 1) failed to do so. This supports the significance of each of the relationships in Model A.

However, these results do not necessarily eliminate competing causal explanations; more than one causal arrangement for a given set of interconnections may reproduce the matrix. Let us now look at Model B in Figure 2 with its corresponding path coefficients. This model represents the alternative causal explanation that extrinsic and intrinsic rewards result in the adoption of innovations which in turn increases the use of the formal network. Note how this arrangement alters the direct relationships between formal network and the reward variables. These direct relationships now become insignificant, implying that the only motivations for using the formal network are indirect ones.

Table 5 presents the reconstructed correlation matrix, again with actual coefficients in parentheses. This is also an acceptable reconstruction. Both models A and B correspond to observed data. The acceptance or rejection of one model or the other must rely on future research.

The present study does provide some aid for subsequent research. Based on

the causal patterns in Models A and B, one could establish support for Model A by either presenting evidence for the effect of the formal network on innovation, or for a substantial direct effect of either extrinsic or intrinsic reward on the use of the formal network (thus precluding the arrangement in Model B).

Implications

The present and previous studies provide substantial support for the relationship between instructional improvement agencies and the use of classroom innovations. This relationship is important regardless of its causality. Thus some justification can be made for the growth of instructional improvement centers which has been documented by Centra (1976).

Also, both models support the need for structures which reward good teaching and support the personal satisfactions one can derive from teaching. The earlier study (Kozma, in press) supports the differentiated effect of these two sources of reward. Extrinsic rewards promote the use of technical or machine base innovations, while instrinsic rewards favor non-technical innovations.

The differences between Model A and Model B also have implications for instructional improvement agencies. Staffing, strategies and the internal distribution of resources is different for each model. In the first case, centers would be primarily staffed by psychologist or educational researchers who would consult with faculty members on the use of various techniques in their classrooms. Model B, however, implies that faculty members have already decided on an innovation previously and come to a center for some assistance in implementation. In this case the agency would be staffed by technicians and would support instructors with advice, equipment, software and small grants. The fact that many agencies provide both is a hedge against each model and confounds research in this area.

I hope to shed some additional light on these issues as a result of research I have recently begun. With grant support from the Exxon Education Foundation I am interviewing recipients of support from four agencies: the Exxon Education Foundation, the National Science Foundation, the Center for Personalized Instruction at Georgetown University, and our own Center for Research on Learning and Teaching. Among the questions I am pursuing are these:

- Are the UM results replicable?
- Are instructional innovations institutionalized once adopted?
- What is the causal relationship between agencies and innovations?
- What is the precise role of colleagues in the adoption of instructional innovations?

Maybe next year in Boston I will have some more precise answers to these questions.

TABLE 1

Correlations of Number of Innovations Used and Independent Variables

	1	2	3	4	5
1. Number of innovations used	--	.51**	.22**	.30**	.28**
2. Extent of use of formal network		--	.13	.16*	.18*
3. Extent of use of informal network			--	.25**	.09
4. Extrinsic reward				--	.02
5. Intrinsic reward					--

*p<.05
**p<.01

TABLE 2

Summary of Variance in the Use of Two Types of Innovations Accounted for by Index of Communication and Reward

Variable in regression	df	% variance Accounted for	F
Full model	4	35.2	---
Formal network	1	25.3	53.12**
Extrinsic reward	1	4.7	10.36**
Intrinsic reward	1	3.7	8.58**
Informal network	1	1.0	2.32
Residual	151	64.8	---

**p<.01

Table 3

Reconstructed Correlation Matrix
Based on Model A

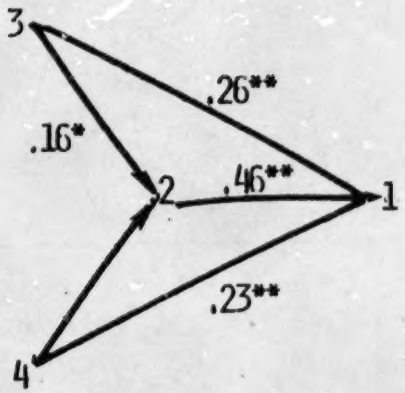
	1	2	-3	4
1. Number of innovations used	-	.54(.51)	.33(.30)	.31(.28)
2. Formal network		-	.16(.16)	.18(.18)
3. Extrinsic reward			-	.00(.02)
4. Intrinsic reward				-

Table 4

Reconstructed Correlation Matrix

Based on Model B.

	1	2	3	4
1. Number of innovations used	-	.47(.51)	.30(.30)	.29(.28)
2. Formal network		-	.16(.16)	.18(.18)
3. Extrinsic reward			-	.00(.02)
4. Intrinsic reward				-

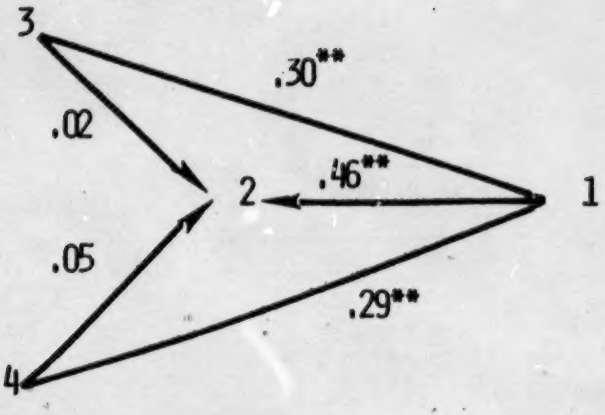


* p< .05

** p< .01

1. Number of innovations used
2. Formal network
3. Extrinsic reward
4. Intrinsic reward

FIGURE 1 Causal Model A



* p <.05
** p <.01

1. Number of innovations used
2. Formal network
3. Extrinsic reward
4. Intrinsic reward

FIGURE 2 Causal Model B

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